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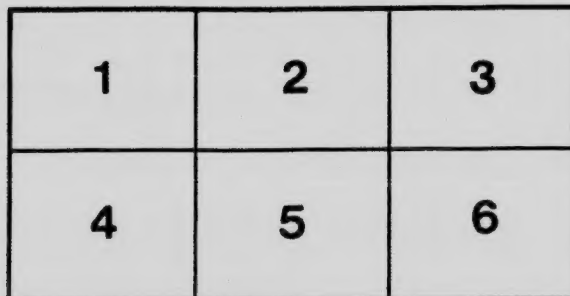
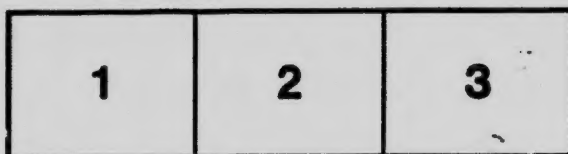
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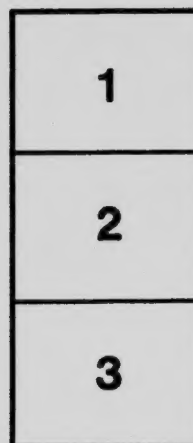
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BULLETIN NO. 7

GOVERNMENT OF THE PROVINCE OF SASKATCHEWAN
DEPARTMENT OF AGRICULTURE

WEEDS
OF THE
FARM and RANCH

BY

T. N. WILLING
(Chief Inspector of Weeds)

PUBLISHED BY DIRECTION OF THE HON. W. R. MOTHERWELL
COMMISSIONER OF AGRICULTURE



REGINA
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1908

HON. W. R. MOTHERWELL, M.L.A.,

Commissioner of Agriculture.

SIR,—

I have the honour to submit Bulletin No. 7 of the series issued by this department, entitled "Weeds of the Farm and Ranch," being a revision of Bulletins Nos. 7 and 16, "Plants Injurious to Stock" and "Hints for the Grain Grower," of the North-West Territorial series.

The illustrations are the same as have appeared in former editions of the above mentioned bulletins, the small figures with the exception of poverty weed and sweet grass being duplicates of those used in Britton & Brown's Flora, by permission of the proprietors of that work. A number have appeared in bulletins of the Ontario Agricultural College, the Central Experimental Farm and other publications, while shepherd's purse, tansy mustard, Russian pigweed, blue bur, whitlow grass and the coloured plate are from drawings by Norman Criddle, of Aweme, Man., the last mentioned drawing having been presented to the department by Dr. James Fletcher, of Ottawa, who has taken such a keen interest in the campaign against weeds.

Brief directions are given for preventing injury to crops by insects, gophers, smut and potato scab.

I have the honour to be, Sir,

Your obedient servant,

T. N. WILLING,

Chief Inspector of Weeds.

DEPARTMENT OF AGRICULTURE, Regina, July, 1908.

PREPARATION OF THE SOIL FOR A GRAIN CROP.

BREAKING.—The first step, after the selection of the land, in the production of a grain crop is the breaking of the sod, and a great deal depends on how this is done. Prairie land has given best results when ploughed in June, with a share 12 or more inches in width, as shallow as the nature of the surface will permit of clean work being done, which is usually about three inches, and reploughed in the same direction a little deeper, or backset as it is termed, about six weeks later, by which time the sod should be well rotted. After backsetting a good seed bed may be prepared with the disc harrow and the land is then ready for seeding in the spring.

It will pay well to break no more than can be done properly and worked thoroughly. When the land is broken very early in the season much of the vegetation is not killed but accommodates itself to changed conditions and continues to grow, but when ploughing is done after growth has advanced a little most of the herbage will be killed. The rotting of the sod will be greatly helped and facilitated by discing, smoothing down with a planker, or by rolling after breaking in order to pack the soil closely so as to retain moisture, which, with heat, is necessary to induce fermentation for the breaking down of the vegetable matter and mellowing of the soil. Late breaking is apt to dry out too much to allow the vegetation to rot, and this is also true of the sod when set up on edge or in kinks.

Where land is slightly scrubby it is not advisable to attempt the backsetting method but rather to set the plough deep enough to cut below the crown of the root and also furnish soil enough to form a seed bed when well disced. If backsetting were done the scrub would interfere with seeding operations.

SECOND CROP.—After the first crop has been taken there is no doubt that if the land were summer-fallowed it would tend greatly to the elimination of the roots of rose bushes, snowberry and other perennial native growths, but the average settler is desirous of quick returns from his work and consequently sows again with a drill after burning the stubble in the spring. This system usually results in a good crop where the soil is heavy, but if the soil is light it is better to cultivate before sowing, and in any case should be summer-fallowed before being again cropped.

FALL PLOUGHING should only be practised when there is abundant moisture in the soil and the plough should be followed closely by the drag harrows leaving the land in shape for spring seeding.

SUMMER-FALLOW.—The bare summer-fallow is considered essential by the most successful grain growers in Saskatchewan and many parts of Manitoba. Its purposes are many, the most important being

the storing or saving of moisture from one year to the next for the production of a full crop in dry seasons when the rainfall would otherwise be insufficient. Another reason is that it gives an opportunity and is the means of destroying the numerous weeds which spread so rapidly and rob the soil of moisture and fertility. It permits also of a larger area of land being made ready for seeding as it is done at a time when other work is not pressing. On the well managed wheat farm one-third at least of the land under cultivation is summer-fallowed each year. The following extract from the Report of Experimental Farms for 1901 gives the experience gained at the Indian Head Farm. It will be seen that Mr. Mackay speaks emphatically in favour of the summer-fallow properly conducted:

"It is very gratifying to know that throughout the Territories, summer fallowing is rapidly becoming general. No matter where farming is carried on, the farmers realise that to be sure of a crop they must prepare a portion of their land the year before the crop is grown, and apart from the value of the stored moisture, there is the inestimable advantage of keeping weeds from over-running the farm.

The true worth of properly prepared fallows was clearly demonstrated in the season of 1900 in every grain growing district of Assiniboia, and although the season just past has been an extraordinary one, the crops grown on fallows were, in every case, the heaviest producers.

It has been observed in Alberta and Saskatchewan that the land to be fallowed is not, as a rule, touched until the weeds are full grown and in many cases bearing fully matured seed. It is then ploughed.

By this method, which, no doubt, saves work at the time, the very object of a summer-fallow is defeated. In the first place, moisture is not conserved because the land has been pumped dry by the heavy growth of weeds; and, secondly, instead of using the summer-fallow as a means of eradicating weeds, a foundation is laid for years of labour and expense by the myriads of foul seeds turned under.

As has been pointed out in my previous reports, early and thorough work on the fallows is absolutely necessary to success, and I here repeat the methods and results of tests carried on for some years past.

First Method—Ploughed deep (6 to 8 inches) before last of June; surface cultivated during the growing season, and just before or immediately after harvest ploughed 5 or 6 inches deep.

Result—Too much late growth if season was at all wet; grain late in ripening, and a large crop of weeds if the grain was in any way injured by winds.

Second Method—Ploughed shallow (3 inches deep) before the last of June; surface cultivated during the growing season, and ploughed shallow (3 to 4 inches deep) in the autumn.

Result—Poor crop in a dry year; medium crop in a wet year. Not sufficiently stirred to enable soil to retain the moisture.

Third Method—Ploughed shallow (3 inches) before the last of June; surface cultivated during the growing season, and ploughed deep (7 or 8 inches) in the autumn.

Result—Soil too loose and does not retain moisture. Crop light and weedy in a dry year.

Fourth Method—Ploughed deep (7 to 8 inches) before the last of June; surface cultivated during the growing season.

Result—Sufficient moisture conserved for a dry year and not too much for a wet one. Few or no weeds, as all the seeds near the surface have germinated and been killed. Surface soil apt to blow more readily than when either of the other methods are followed. For the past fourteen years the best, safest and cleanest grain has been grown on fallow worked in this way and the method is therefore recommended.

Fallows that have been ploughed for the first time after the first of July, and especially after July 15, have never given good results; and the plan too frequently followed of waiting until the weeds are grown, and often ripe, and ploughed under with the idea of enriching the soil, is a method that cannot be too earnestly advised against.

In the first place, after the rains are over in June or early in July, as they usually are, no amount of work, whether deep or shallow ploughing, or surface cultivation can put moisture in the soil. The rain must fall on the first ploughing and be conserved by surface cultivation.

Weeds, when allowed to attain their full growth, take from the soil all the moisture put there by the June rains, and ploughing under weeds with their seeds ripe or nearly so, is adding a thousand-fold to the myriads already in the soil and does not materially enrich the land."

It may be well to point out that the Larrow is most effective when used immediately after or at the time of ploughing for summer-fallow as the soil is then more easily smoothed over, thus helping to retain the moisture and also leaving the land in a better condition for effective weed destruction by subsequent harrowing. Some persons in carrying out this idea before leaving the field at night harrow what they have ploughed during the day, others attach a section of the harrows behind the plough and thus lose no time.

CULTIVATION.—Great benefit has been shown to be derived from cultivation of the growing crop, not only as a means of destroying weeds, but as a means of preventing too rapid evaporation of the moisture from the soil. For this purpose a special implement known as the weeder has been in use several years and is very highly recommended, but good work has been done with an ordinary light drag harrow or what is better a harrow in which the teeth may be sloped backwards a little. The following was written in 1900 by Dr. J. Fletcher about the use of this implement:

"The introduction of weeders into the dry regions of the West I consider an event of enormous importance to all grain growers. During the past five summers I have had exceptional opportunities, in driving through Manitoba and the North-West Territories, of meeting and seeing the farms of some of the best farmers in the West. In many places I have met men who make a practice of harrowing their growing crops with a light harrow, and invariably with great advantage. Upon the introduction of the various weeders these were used by a few of the most enterprising settlers, and almost always with decided satisfaction. So much was this the case that last spring several carloads of them were shipped into Manitoba by implement makers. The season of 1899, however, was so wet and late that the weeders were not used so much as would ordinarily have been the case. From what I have seen of these implements, particularly at the Indian Head and Brandon Experimental Farms, and from what I know to be the condition of the wheat fields of Manitoba and the North-West Territories with regard to the annual weeds, I am convinced that there is more to be hoped for in the regular use of these implements after the grain is up than from any other measure so far suggested for cleaning lands infested by such aggressive and persistent agricultural pests as chick weed and the different kinds of mustard, as well as all other seedlings growing among grain crops. Weeders can be used not only safely but with the greatest advantage to a grain crop from the time the blade is an inch high until the plants have shot up 6 or 8 inches.

One of the frequent complaints made against weeders by western farmers is that they cover too narrow a strip of the crop at a time, but by uniting two of these implements and covering 24 feet at once, a man has gone over nearly 50 acres in a day. The two weeders were fastened together with a rope, and the horses were kept apart by a stick between the halters.

The wheat in the fields thus treated had been cultivated twice after it was four inches high, and it was stated, as has been found by many others to be the case, and as I have myself frequently seen, that if properly used when the weeds are very small nearly all weeds can be destroyed. On July 18th the wheat thus cultivated was 4 feet high and nicely in head. The field was 70 acres of the first crop after summer-fallowing. It yielded 29 bushels, while a large field that we thought did not require the weeder yielded only 17 bushels. Mr. Mackay, at Indian Head, has the greatest confidence possible in these implements."

SEEDS AND SEEDING.

SEED.—It is not the intention to advise in this Bulletin as to the choice of varieties of grain to sow, but it may be stated that on a proper selection of seed depends the success or failure of the crop. The variety should be hardy and prolific, early ripening being also a great advantage in this country. Whatever the kind chosen the seed should be plump, sound and of good vitality.

SEED TESTING.—To ascertain the possession of the latter quality a test should be made. This can be done in a rough-and-ready manner by counting out one hundred grains, placing them between pieces of wet flannel on a dinner plate and covering them with another plate. This should be kept, with sufficient moisture, where the temperature will be about 60° F. At the end of five days count and remove the grains that have sprouted and repeat this after the tenth day. You will thus have a fairly accurate indication of the percentage of good seed in your sample of grain suitable for seed; 90% should germinate and when seed of less quality is used a greater quantity must be sown.

CHANGE OF SEED.—There is an idea, more prevalent some years ago than now, that better crops may be secured by procuring seed from a distance, or in other words "changing seed." No doubt grain grown by some farmers does "run out," but this is due to shiftless farming. Grain should be more suited to a district and more productive the longer it is used if only the best is selected and sown each year on properly prepared land, free of weeds and smut.

QUANTITY TO SOW.—The usual quantity sown is wheat 1½ bushels per acre, oats 2½ bushels, barley 2 bushels. It has been found that a crop from thin sowing usually takes longer to ripen, and the same may be said of deep sowing, but in a very dry season the deeply sown grain gives best results. Various styles of drills are used, some being better adapted to certain soils than others.

SEEDING TESTS were carried on for a period of eight years, 1892-9, at Indian Head Experimental Farm on summer-fallowed clay loam. The wheat used was Red Fife and was sown on the 27th of April:

	Bush.	Bush.	Bush.
2 inches deep—least yield per acre	15	greatest 45	average 34.47
3 " " "	18	" "	38.5
1 bushel " "	14.3	" "	38.3
1¼ " " "	11.4	" "	44
1½ " " "	13.2	" "	42.2
Hoe drill " "	17.50	" "	45.40
Press drill " "	18.40	" "	45
			36.38

WEEDS.

Weeds are, from the farmers' point of view, such native or introduced plants as by their more vigorous habit of growth tend to reduce the production of marketable crops, or, such plants as in any way may prove injurious to animals. Certain weeds known to be of bad character, mostly natives of other countries, have been officially listed as noxious and under the provisions of The Noxious Weeds' Ordinance must be destroyed by the owners of property. The mere fact of some of these weeds being found on farms has a very depressing effect on the selling value of the land and there is no doubt that when weeds are abundant on a farm they add greatly to the cost of producing a crop. They use the plant food and moisture which is wanted by the crop. The space they occupy should be filled by profitable plants. They necessitate the use of more twine at harvesting, are a tax on machinery, cause a vexatious loss of time and reduce the value of the grain for market.

An increase of one bushel of grain per acre might easily be secured by the little extra cultivation necessary to suppress the weeds and this would mean about four million bushels added to the aggregate product of the province in a season. Can the farmers afford to lose the amount of money represented by this? *Any weed can be eradicated* from a farm by adopting the proper method and persistently and intelligently following it. The nature of the plant, the character and condition of the soil, the state of the weather should all be considered if we would get the best results from our work.

WAYS OF SPREADING.—Weeds spread by natural means such as seeds being carried by the wind in summer or drifting with and over the snow in winter. Birds and other animals carry them attached to their feathers, hair or feet and many seeds that have been consumed are passed in the dung without their vitality having been impaired. Streams aid greatly in distributing seeds and consequently the banks of irrigation ditches should be watched closely and kept clear of them. They are spread by the agency of man in poor grades of seeds, amongst feed grain or fodder, in material used for packing goods, and by means of farm machinery being moved from field to field.

CLASSIFICATION.—All plants may be included in one of the following three classes: Annuals, or one-year plants; biennials, or two-year plants; and perennials, or many year plants. The method of destruction to be adopted is decided largely by consideration of the class to which the plant belongs.

ANNUALS spread by means of seeds, producing only one crop and then dying. If they start growth early enough in the season they ripen seed before frost, but if not, only the hardiest survive the winter and then produce seed in the spring or early summer. These hardy species such as stinkweed, shepherd's purse, peppergrass, etc., are known as winter annuals. Any method by which the germination of the seed in the soil is hastened and the young plants destroyed before they produce

fresh seed must in time clean the land, however badly infested it may be with annual weeds. The seeds of some annuals have great vitality, and these weeds will continue appearing for several years as fresh seeds are brought to the surface by cultivation; those of the wild mustard, shepherd's purse and peppergrass have been known to germinate after lying deep in the ground for twenty years.

BIENNIALS seldom bear flowers or seed the first year but store food in their roots for the production of stalks and seed the following season. Examples of this class are the false tansy and the common evening primrose and are most troublesome in crops sown on stubble. They must be either ploughed or cut down before they flower. Mowing at short intervals will kill them; but a single mowing may only induce them to send out later branches, which, if not cut, will mature many seeds. Where ploughing or cultivating with a duck foot cultivator is impracticable, this class of plants should be cut off below the crown of the root with some suitable tool such as a large chisel at the end of a long handle.

PERENNIALS live for many years spreading both from seed and by underground stems. Their roots are either shallow or deep, the shallow rooted group being represented by such weeds as couch grass and yarrow; the deep rooted are the Canada thistle, field sow thistle, blue lettuce, white stemmed evening primrose and similar plants. They are the most troublesome class of weeds to eradicate when well established but shallow cultivation, such as hoeing, continued so as to prevent the growth of leaves, or deep ploughing when the plants are in bloom are effective means of destroying them.

METHOD OF ERADICATION.—Hand pulling is most effective in the case of annuals and biennials and is a means of saving many a farm from being overrun with weeds. One weed left to ripen seed means that many hundreds of thousands of it may be found there another season. A walk through the growing crop can be made very profitable by the pulling and burning of even a few weeds. Care should be taken after pulling not to throw down the weeds with partly grown seeds as many of them will ripen sufficiently to grow.

Shallow cultivation is death to annuals and if frequently repeated is equally effective for all weeds, whether practiced with a hoe, plough, or flat tooth cultivator. Plants cannot live for any length of time without leaves, which are absolutely necessary for their survival, therefore by cultivating so as to prevent the growth of leaves the roots must die. The drag harrow will only kill weeds if used when the soil is in good tilth and the weeds are in seed leaf or very young and tender, when a stirring of the soil on a bright hot day will expose the roots to the sun with fatal effect.

Deep ploughing for the destruction of perennials should be done at the time when they are weakest and that is just as they come into bloom. The weeds should be completely covered by using a chain on the plough, or cut and removed before ploughing. Later in the

season the deep ploughing should be followed by shallow cultivation with duck foot cultivator or sharp plough to destroy any growth that may have sprung up.

Spraying is a good method of destroying weeds on gravel walks or roads, but it is not recommended as a practical way of dealing with the weeds of our extensive grain fields. In the first place the strength of the spray would have to be very strong to kill all the species of weeds found in the grain and then it would injure the grain also. The 2% bluestone solution, which does not injure the grain, has been found effective for the destruction of wild mustard, but it is not equally destructive to the weeds most abundant and troublesome in the province. The soil would not be benefited by spraying as it would be by cultivation and the expense of treating large areas would be out of proportion to the profit.* Spraying was first advocated and practised in the old country, and it will be of interest to see what has been written of the system in the Journal of the Board of Agriculture, England. It will be seen that the method advocated in preference is that found in practice most suited to our land:

"The system I propose to describe is one that has been carried out with great success for several years on a farm of 400 acres in East Anglia, and will, it is believed, supersede the system of spraying so much advocated of late years. Spraying, at the best, is an expensive operation, and up to the present has been effectual in the case of only a very few weeds, principally charlock. By our method all seeds may be destroyed.

The climatic conditions prevailing in the eastern counties differ, as is generally known, from those of the rest of England in that the rainfall is lighter."

The system referred to consists in frequently stirring the surface of the soil, with the following result:

1. The growth of weeds is prevented.
2. The soil is maintained in a fine condition so as to retain the moisture.
3. The spread of injurious grubs, wireworm, etc., is checked.
4. The soil is kept entirely at the service of the desired crop.

There is an old saying, "When a crop stands still stir the soil," and our method is an extension of this principle. We stir the ground repeatedly for as long as the crop will allow, and find that the process is a beneficial one to the thriving crops as well as to the most unpromising ones.

*A bulletin has been recently issued by the North Dakota Experiment Station in which the results of extensive experiments in spraying for the destruction of weeds are given. It is shown that some weeds may be destroyed or checked in crops by spraying without injury to the grain. The words of the bulletin are: "The following named weeds may be eradicated or largely subdued in cereal grain fields through the use of chemical sprays: False flax, wormseed mustard, tumbling mustard, common wild mustard, shepherd's purse, pepper-grass, ball mustard, corn cockle, chickweed, dandelion, Canada thistle, bindweed, plantain, rough pigweed, king-head, Red River weed, ragweed, cocklebur.

The following weeds are not effectively controlled by chemical sprays as now used: Hare's-ear mustard, French weed, pink cockle, perennial sowthistle, lamb's quarters, pigeon grass, wild oats, chess, sweet grass and wild barley."

Iron sulphate is said to effectively destroy wild mustard on one acre of land when the solution is made by using 75 to 100 lbs. in 52 gals. water; copper sulphate may be used at the rate of 12 to 15 lbs. for 52 gals.; common salt gives good results when about one-third barrel to 52 gals. is used; sodium arsenite (poison) may be used at the rate of 1½ lbs. to 52 gals. water.

A spraying machine capable of throwing a very forcible misty spray is necessary and is said to cost from \$60 to \$150 in Dakota, where iron sulphate may be had for from 90c to \$1.10 per hundred lbs. and copper sulphate at 5 to 10 cents per lb.

The frequent use of horse implements takes the place of hand labour. The only weeding done by hand is spudding docks and removing the thistles left by the horse-hoe in the rows of corn (wheat). Of course where the work for some reason or other has been indifferently done an additional six-pence per acre is well spent by pulling any weeds that may have come into flower at the time of docking and spudding."

SEEDING TO GRASS.—When a larger area of land is badly infested with weeds than can be conveniently handled it will pay to seed a portion with brome grass in the spring after a shallow ploughing. The growth should be kept closely mown during the first season so that few weeds may mature seed. It must be remembered, however, that the grass will only keep the weeds in check by its strong growth, but will not eradicate them from the soil. Proper cultivation for eradication should be resumed some future season.

TO PREVENT WEEDS IN GRAIN FIELDS.

Break your land thoroughly, and backset if possible.

Sow only clean seed, and reclean the cleanest before sowing.

See that the drill is empty before you put seed into it.

Harrow the growing crop to kill seedling weeds.

Be able to recognise the weeds, and inform yourself as to their habits of growth.

Walk through the crop and pull the few weeds you may then find, as one destroyed may prevent the production of hundreds or millions of seeds, according to the nature of the plant.

Watch the headlands carefully, and keep the edges of the fields clear of brush and rubbish that might prevent close cutting. Have the binder clean.

Stack and thresh in the same place each season, and watch those places closely for weeds.

Wandering stock should be kept away from the straw stacks. Allow no threshing machine on your farm that has not been cleared of screenings and swept down.

Keep separate the first few bushels of grain threshed and boil it for the pigs.

Carefully gather and care for the screenings after the separator is removed.

No grain containing seeds of weeds should be fed to the farm horses or other stock, unless it be boiled or finely ground, because seeds may pass through the animals, and so be dropped in the manure.

Call your neighbour's attention, in a friendly way, to any weeds you may notice on his land, and set a good example by keeping the road allowance by your farm clear of weeds. Do not drive over weedy fields or roads if you can avoid it, as seeds may be carried on horses' feet, or on wheels.

NOXIOUS WEEDS.

Section 2, subsection 1, as amended of The Noxious Weeds Ordinance: The expression "Noxious Weeds" shall include:—

TUMBLING MUSTARD,
HARE'S-EAR MUSTARD,
COMMON WILD MUSTARD,
BALL MUSTARD,
TANSY MUSTARD,
WORMSEED MUSTARD,
FALSE FLAX,
SHEPHERD'S PURSE,
STINK WEED,
RED ROOT,
CANADA THISTLE,
RUSSIAN THISTLE,
RAGWEED,
WILD OATS,
RUSSIAN PIGWEED,
BLUE BUR,
PURPLE COCKLE,
COW COCKLE,
FIELD SOWTHISTLE.

TUMBLING MUSTARD—*Sisymbrium altissimum*, L.

HISTORY.—It is about eighteen years since this weed was first seen in this country, and shortly afterwards it overran the Indian Head district, spreading rapidly from there to the east, west and south throughout the prairie region because of its rolling habit when ripe.

DESCRIPTION.—Annual; sometimes a winter annual as it is normally in Europe. The early stage is a rosette of thin, hairy, deeply-toothed leaves flat on the ground, from which a branching stem grows to a height of two or three feet bearing finely divided leaves which fall away when the plant ripens. The flowers are pale yellow in colour and produce slender pods about three inches in length, each one containing about 120 seeds. A single plant of vigorous growth has been known to bear one million and a half seeds. The seeds are very small and of a greenish yellow colour. When the plant is ripe it breaks off and is blown by the wind, scattering its seeds far and wide.

ERADICATION.—Hand pull when possible, especially about the edges of fields and along roadsides. Cultivate growing crops with harrow or weeder to kill weeds while young. Summer-fallow if necessary. See that firebreaks are kept clean, as the supply of this weed is kept up by the rolling plants from such places.



Tumbling Mustard.

HARE'S-EAR MUSTARD—*Conringia orientalis*, Andr.

OTHER NAMES—Klink weed.

HISTORY—Introduced from Europe. It was reported from Manitoba in 1894, and from Assiniboia in the same year. Mr. Mackay of the Indian Head Experimental Farm at that time wrote:

"This weed is not on the farm, but is found five miles from here and has caused considerable loss to the farmer on whose place it obtained a foothold. I think it is only on the one farm and has been there for five or six years."

It was found in Alberta shortly after at the site of a railway construction camp, 40 miles north of Calgary. From that time it has been steadily spreading throughout the grain growing districts and has proved itself a very troublesome weed.

DESCRIPTION—Although ordinarily an annual late plants do live through the winter and ripen seed early the next summer. The young plant is a rosette of roundish, juicy leaves flat on the ground, but as it grows in size the leaves assume the appearance of those of a young cabbage plant. On the stiff slender stems, which become very wire-like when mature, the leaves are shaped like the ear of a hare and are closely attached or clasping. The flowers are creamy white and from them at the tips of the branches the square pods about four inches in length are produced. The seeds ripen about August, are of a brownish, black colour when ripe and about one-twelfth of an inch in length.

ERADICATION—Pull by hand or summer-fallow if necessary, being careful to leave no living plants on the field in the fall.



Hare's-Ear Mustard.

WILD MUSTARD—*Brassica sinapistrum*, Boiss., L.

OTHER NAMES—Charlock, cadluck, herrick.

HISTORY—Brought into Canada from Europe and has become one of the worst weeds in Ontario, being very persistent also in parts of Manitoba. In Saskatchewan it is most abundant in some of the northern settlements, and plants may usually be found at stations on the railway where settlers' effects have been unloaded, thus illustrating the manner in which many weeds are introduced.

DESCRIPTION—Annual. Leaves resemble those of turnip, being dark green, bristly and lyre shaped, a large lobe at the end and smaller ones at the sides. The upper leaves are pointed. The stem is coarse and bristly, sometimes attaining a height of three feet, a purplish blotch is found at the junction of the branches. The flowers which appear from June to September are yellow and about two-thirds of an inch across. The seed pods are from one to two inches in length, about a third of this being a somewhat flattened beak containing one seed, the other portion of the pod has a knotted appearance and contains numerous round brownish seeds.

ERADICATION—Hand pull all the first plants noticed and practice shallow cultivation, summer-fallow infested fields. As seeds of this weed retain their vitality for many years when buried deeply, care should be taken not to plough them under but rather to induce them to germinate and then to destroy the young plants by further cultivation. Spraying has in Great Britain been successfully used for the destruction of this weed but it can hardly be recommended as suited to conditions in this province. The method as given in an Ontario bulletin is, "Spray with a 2% solution of blue stone, copper sulphate, which is made by dissolving one pound in five gallons of water, or nine pounds in forty-five gallons of water. It is necessary that the plant be sprayed early, just when coming into bloom on a bright day to obtain the best results. Forty-five gallons should spray an acre."



Wild Mustard.

BALL MUSTARD—*Neslia paniculata*, Desv.

OTHER NAMES—Yellow-weed.

HISTORY—A native of Europe first noticed in Manitoba and westward less than twenty years ago, but now found in all the grain-growing sections of the country, and especially abundant and troublesome in the northern districts, where the rapidity of its spread has been startling.

DESCRIPTION—Annual and winter annual. A slender plant two or three feet in height with narrow pointed leaves clasping the stem. The dark yellow flowers appear at first in clusters at the ends of the branches, but as the stems lengthen the round shot-like pods are found scattered along them on thin stalks less than an inch in length. The wrinkled pod, which does not split open when ripe, contains one small yellow seed.

ERADICATION—Pull and burn all possible; give special care to the edges of the fields; cultivate badly infested fields in the fall and then plough late in the spring and sow crop to be cut green. Carefully clean your seed grain.



Ball Mustard.

TANSY MUSTARD—*Sisymbrium incisum*, Engl., vars.

OTHER NAMES—*Sisymbrium incisum*, variety *filipes*, is known as green tansy mustard. *Sisymbrium incisum*, variety *Hartwegianum*, is gray tansy mustard.

HISTORY—Both natives and only give trouble in a crop when it has been sown on stubble or when a summer-fallow has been neglected during the latter part of the season.

DESCRIPTION—Biennial, a rosette of leaves being the first year's growth. Slender plants growing to a height of two to four feet, with finely divided leaves, bright green in one form and gray green in the other; the latter is the coarser and ranker growing plant. They produce a great number of small yellow flowers, the fruit being a narrow pod less than three-quarters of an inch in length. The minute seeds are longer than their breadth and brownish red in colour.

ERADICATION—Fall and spring cultivation and hand pulling.



Green Tansy Mustard.

WORMSEED MUSTARD—*Erysimum cheiranthoides*, L.

OTHER NAMES—Treacle mustard.

HISTORY—A native which responds quickly to cultivation, making a rank growth on stubble or about edges of fields. The seeds have a very pungent and acrid flavour objectionable to stock.

DESCRIPTION—Annual and biennial. Slender and inconspicuous in the wild state but growing a stout stem three feet or more in height in the grain crops. The leaves are lance shaped and several inches in length. The flowers are small and yellow. The pods are slender, about one inch long and grow at an angle with their small stalks being parallel with the stem or branch to which they may be attached. Seeds are very small and brownish yellow in colour.

ERADICATION—Cultivate in fall and spring, hand pull.



Wormseed Mustard.

FALSE FLAX—*Camelina sativa*, Crantz.

OTHER NAMES—Balloon mustard, gold of pleasure.

HISTORY—A weed of the flax crop in Europe and introduced into America many years ago. In this country it is quite abundant in the grain fields and grows thriftily to the great detriment of the crop. It has been found that some of our foreign immigrants are using the weed as an article of food. An oil resembling that of linseed may be extracted from the seed and also mucilage from the seed coat as with linseed.

DESCRIPTION—Annual and winter annual. A plant of the mustard family about two feet in height with a somewhat branching stem; its leaves are a few inches in length, and lance shaped, the upper clasping the stem with their bases, the edges being sometimes slightly toothed. The flowers are in loose clusters and are pale yellow in colour giving place to pear or balloon shaped pods about a quarter of an inch in length which contain about sixteen reddish yellow seeds.

ERADICATION—Hand pull, cultivate fall and spring, or summer-fallow.



False Flax.

SHEPHERD'S PURSE—*Capsella bursa-pastoris*, Medic.

HISTORY—Introduced in garden seeds from Europe by way of Ontario, where it is well known as a garden weed. In the prairie provinces it has proved itself capable of doing serious damage not only to gardens but to wheat fields, inspectors reporting it as being in certain localities more injurious to crops than stinkweed. It is abundant on the roadways in some of the older settlements.

DESCRIPTION—Annual and winter annual, ripening seeds throughout the season. The plant consists of a tuft of toothed or deeply notched leaves at the ground, from which a more or less branching stem arises bearing clusters of small white flowers which produce flat triangular pods containing a score or so of very small reddish yellow seeds. These seeds may be buried deeply and yet grow when brought near to the surface again after many years.

ERADICATION—Constant hoeing or shallow cultivation with sharp implement. Summer-fallow infested fields.



Shepherd's Purse.

RED ROOT—*Amarantus retroflexus*, L.

OTHER NAMES—Pigweed, Chinaman's greens.

HISTORY—Originally from tropical America, it has been well established in Ontario as a barnyard, field and garden weed, and has probably been introduced to the West from there. It has as yet given very little trouble in the grain fields of Saskatchewan but is abundant and very troublesome in gardens. The leaves are sometimes used as a pot-herb.

DESCRIPTION—Annual. A coarse erect plant with pink coloured root, and light green oval pointed leaves. The flowers are green and inconspicuous on crowded spikes. The seeds are round, flattened, about the size of a small pinhead and of a shining black colour.

ERADICATION—Cultivate shallow and hand pull, giving special attention to gardens late in the summer and fall.



Red Root.

STINKWEED—*Thlaspi arvense*, L.

OTHER NAMES—Penny cross, French weed.

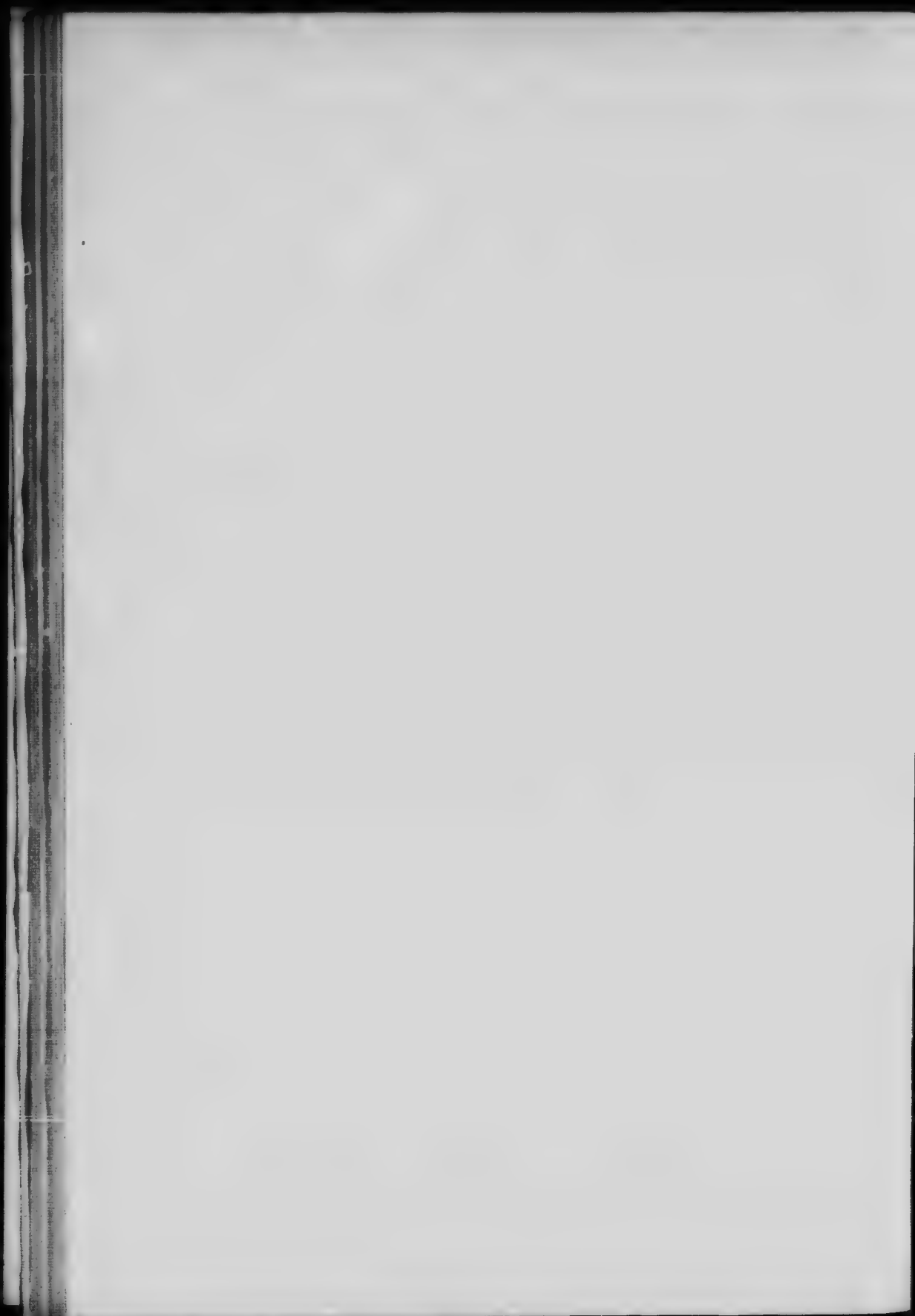
HISTORY—Introduced from Europe to Manitoba in the days of the fur trade and carried westward from there in seed and feed grain by early settlers, freighters and railway contractors, and is now one of the worst pests of the wheat fields.

DESCRIPTION—Annual and winter annual, plants being found in bloom when snow goes and throughout the season, the plants that have wintered ripen early in June and others of spring growth produce seed before harvest. A foul-smelling plant, averaging one foot in height, with smooth dark green leaves and clusters of small white flowers which develop into flat round leaf-like pods. The leaves fall away and the pods become yellowish as they ripen. A pod contains about a dozen reddish brown seeds, many thousands of which may be produced by one plant.

ERADICATION—Hand-pulling and burning is the best method to adopt when the area infested is small, but if that is not possible the land should be cultivated with harrow or other implement to cover what seed may be on the surface and cause it to germinate. The harrow should again be used when the young plants are just showing above the ground, the hotter the day on which this is done the better the result. If there is a heavy growth of weeds they should be mowed, gathered and burned rather than ploughed down, as it is a well-known fact that if the seed pods are on the plant at the time they are turned under they may ripen seed in the ground and produce another crop of the weed. Close attention should be given to any portion of the farm where stinkweed has been noticed, and careful, persistent work will be required to eradicate it, but it should not be forgotten that it will pay well to drop all other work and fight this weed when first noticed. If a field under crop is *badly infested* I would recommend the use of the disc or harrow as soon as the crop is removed and in spring after the weeds have made a new start plough them under and harrow at once. As soon as there is any growth cultivate again and continue this treatment throughout the season, being very particular to leave no weeds alive when winter sets in. The following spring a crop should not be sown until weeds have been destroyed again by cultivation, and then a crop of barley would probably be best, as it would be removed in time to permit of cultivation before winter. If so much land is badly infested that the whole of it cannot be properly dealt with for eradication, cultivate a portion fall and spring and then sow brome grass at the rate of about 15 lbs. per acre and mow closely throughout the season to prevent any weeds ripening seeds. This will keep the stinkweed in check while you give attention to the other portion of the field. After working on infested fields care should be taken to clean machines thoroughly before moving them to clean portions of the farm as seeds are very apt to be carried.



STINKWEED (*Thlaspi arvense*, L.)

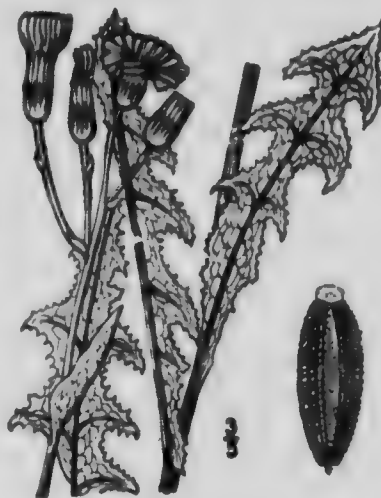


FIELD SOWTHISTLE—*Sonchus arvensis*, L.

OTHER NAMES—Perennial sowthistle, corn sowthistle, milk thistle.

HISTORY—A European weed of the grain fields which in Canada has proved itself one of the most difficult to eradicate from the fields, having in Manitoba overrun large areas in the southern portion of that province, necessitating special legislation for the control of it. In Saskatchewan it has not yet become established but stray plants have been picked up at various points throughout the province where seeds have been accidentally dropped.

DESCRIPTION — Perennial spreading by rootstocks deep in the ground and by seeds carried by the wind. It grows to a height of three or four feet having smooth bright green leaves which clasp the stem and are surrounded by weak prickles. The flowers, which grow at the top of the stem, resemble those of a dandelion being about an inch and a half across and of a bright yellow colour. The plant has a milky bitter juice.



ERADICATION—The first noticed in a field or along the roadsides should be dug out with as much of the root as possible and burned, care being taken that the seeds are not permitted to blow about. If much headway has been made before it is noticed it will be necessary to summer-fallow carefully by ploughing shallow early in the season, following this with cultivation as often as necessary throughout the season to prevent the growth of leaves. A very late fall ploughing should be given, and, in the spring, all growth should be worked down before putting any kind of crop on the land. It would be well if possible to plant potatoes or turnips so that cultivation and hand-pulling might be continued during the season.

CANADA THISTLE—*Cnicus arvensis*, Hoffm.

OTHER NAMES—Creeping thistle, field thistle.

HISTORY—A native of Europe brought to the West by way of Ontario and Manitoba, well established along the railways and in most of the towns, but very few fields are badly infested yet. It has not spread as rapidly as the weeds of the mustard family.

DESCRIPTION—A hardy perennial spreading by underground stems and by seeds carried by the wind. It grows to a height of from one to six feet with narrow crinkled prickly leaves of a dull green colour, and produces a large number of small heads about half an inch in diameter, the flowers being lilac in colour.

ERADICATION—If only a few are noticed dig them out and watch the place for more. A chisel with a long handle is an effective implement with which to keep them down. Thistles may be killed by persistent spudding or by shallow cultivation, thus preventing their growth of leaves without which the roots cannot continue to live. If constant attention cannot be given to an infested field it is best to let the thistles alone until they come into bloom and then, if the growth is heavy, cut, remove and destroy them before ploughing the land deeply. A light growth may be turned under with the aid of a chain on the plough. Subsequent surface cultivation in fall and spring should be practised before seeding to a crop.



Canada Thistle.

RUSSIAN THISTLE—*Salsola kali*, v. *tragus*, Moq.

OTHER NAMES—Russian tumbleweed, Russian cactus.

HISTORY—A Russian weed brought from South Dakota in flax seed about 1873, spreading rapidly therefrom and causing heavy loss to farmers. Its appearance in Manitoba gave rise to considerable alarm and also drew attention to the rapid manner in which other weeds were overrunning the grain fields of Western Canada. This weed, however, has not made much headway in Saskatchewan, although reported as occurring at several points in the southern portion of the province where ranching conditions have prevailed.

DESCRIPTION—Annual. The leaves and branches of the very young plant are tender, threadlike and dark green in colour. With age the plants branch freely, assuming a spherical shape, and becoming somewhat reddish in hue but bleached when ripe. Well grown plants are three or more feet in diameter, each branch being covered with small spine-like leaves in threes, at the base of these prickles are found the small stemless flowers, and later, the seeds. When mature the plant breaks off at the root and rolls over the land to great distances dropping seeds as it goes.

ERADICATION—If attended to early enough in the season this weed is not hard to destroy by fallowing but on account of its stiff prickly nature it is difficult to work with in the advanced stages of its growth. The use of harrows or the weeder on the growing crop of grain will keep all such weeds from making headway. Hand pulling should be adopted when seen in roads or other uncultivated land. It may also be pastured off in its early stage by sheep. Burn old plants.



Russian Thistle,

GREAT RAGWEED—*Ambrosia trifida*, L.

OTHER NAMES—Crownweed, kingweed.

HISTORY—A native found mostly on heavy clay land. Its seeds being difficult to remove are very objectionable in wheat.

DESCRIPTION—Annual. A rough coarse upright weed with large opposite leaves most of which are three lobed. The flowers are of two kinds, the sterile, borne on tapering spikes about four inches in length, being green above and dull yellow beneath; the seed bearing flowers grow close to the stem in clusters at the bases of the spikes and leaf stalks. The seed is about the size of a grain of wheat, but tapering at one end and having hornlike projections just above the middle which suggest the name "crown weed."

ERADICATION—Hand pull or summer-fallow if necessary.



Great Ragweed.

WILD OATS—*Avena fatua*, L., and *A. strigosa*, Schreb.

HISTORY—A weed of all grain-growing countries and now found throughout the province, having spread very rapidly during the last few years through the importation of badly infested seed and feed oats.

DESCRIPTION—Annual. The appearance of the plant closely resembles that of the cultivated oat but the grains are hairy at the lower end, yellow or brownish black in colour, bearing bristle-like twisted and bent awns and are considerably lighter in weight than good oats. Some seeds ripen before the others and fall on the ground.

ERADICATION—After removing a crop from a field infested with wild oats, the land should at once be ploughed very shallow or disced so that such seed as may have dropped will be covered and thus given a chance to begin growth at as early a date as possible. If the oats grow before winter they will be killed by the frost but the most of the seed will not sprout before spring. When there is a good growth started in spring plough just deep enough to destroy that growth and after smoothing with a harrow wait for another crop of the weeds to show and repeat the ploughing a little deeper. Such work may be continued so often through the season as the weeds show but care should be taken not to finish with a late ploughing unless it is the intention to cultivate again in spring after a growth is started before sowing for a late crop. The object of ploughing deeper each time is to bring nearer to the surface the seeds that may be buried too deeply for germination.

The plan to work on is simply to start the seeds into growth and then in some way prevent the plant from producing more seed. Some prefer to do this by turning into the infested field sufficient cattle or sheep to consume the oats as fast as they come up, while others sow barley or other grain to be cut with the wild oats for feed while yet green.

After fall cultivation and the ploughing down of a crop of the weeds in spring some farmers sow early ripening barley, hoping to ripen a grain crop before the wild oats mature, but this is risky.

Do not use seed that has wild oats in it if you can avoid it.



Wild Oats.

RUSSIAN PIGWEED—*Axyris amarantoides*, L.

HISTORY—A hardy native of Russia which appears to have been brought direct to Manitoba by immigrants and has spread especially along the railways till now it is found in all parts of the prairie provinces and has necessitated its proclamation as a noxious weed.

DESCRIPTION—Annual. In its early stages it resembles lamb's-quarters somewhat and like it is without conspicuous flowers but is totally unlike it later. When mature it has a spreading top covered with an abundance of seed which somewhat resembles that of flax but it is a little smaller, dull gray, not so pointed and sometimes slightly winged.

ERADICATION—Hand pull or mow before seed is formed or summer-fallow badly infested fields.



Russian Pigweed.

BLUE BUR—*Echinospermum Lappula*, Lehm.

OTHER NAMES—Stickseed, beggar's-lice.

HISTORY—An introduction from Europe by way of Eastern Canada. Especially noticeable on roadsides and in waste places but also abundant in crops sown on stubble.

DESCRIPTION—Annual and biennial. A grayish green weed seldom growing over two feet in height. Its leaves are narrow and hairy and it has small blue flowers like those of the forget-me-not; the seed has a double row of barbed prickles around its triangular covering which is about one-twelfth of an inch in length and adheres readily to the clothing or to the coats of animals. Plants have a heavy disagreeable odour very perceptible when a number of them are growing together.

ERADICATION—Hand pull, cultivate in fall or spring, summer-fallow carefully and be sure to thoroughly clean all seed sown. Watch the roads and firebreaks.



Blue Bur.

PURPLE COCKLE—*Lychnis Githago*, Lam.

An upright growing annual of European origin with long narrow opposite leaves covered with fine silky hairs. Its flowers are purplish and about one inch in diameter. The seeds are blackish in colour, of a rounded triangular shape, have a rough surface and are of a poisonous nature. Hand pull or summer-fallow and sow only clean seed.

COW COCKLE—*Saponaria vaccaria*, L

A smooth annual growing about two feet high with pointed opposite clasping leaves which are smooth and gray like those of cabbage. Its flowers are pink and about half an inch in diameter giving place to seed pods within a five angled calyx. The seeds are globular with a slightly granulated surface black in colour. It ripens about the same time as wheat. Very abundant in many portions of the province but originally from Europe. Being very conspicuous when in bloom hand picking may readily be practised and summer-fallowing will also be effective treatment.



TROUBLESOME WEEDS NOT MENTIONED IN NOXIOUS WEEDS ORDINANCE.

The figures on this and the following pages are, with the exception of Whitlow Grass, Poverty Weed and Sweet Grass from Britton & Brown's Flora of U.S. and Canada.

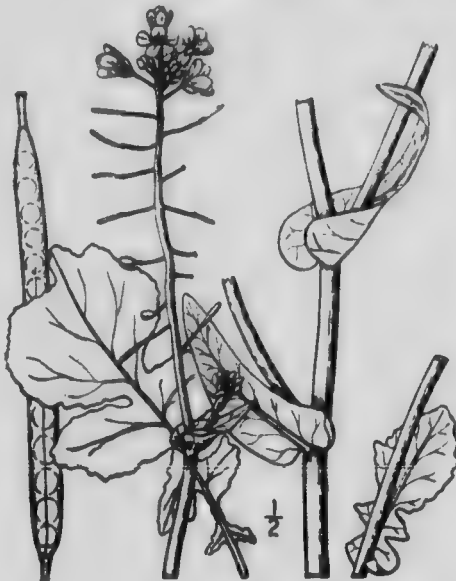
SMALL WALLFLOWER—*Erysimum parviflorum*, Nutt.

A native biennial of the mustard family which sometimes appears ahead of the grain in crops sown on stubble or a carelessly worked summer-fallow. Its flowers are yellow and about a quarter of an inch across; the slender seed pods are about two inches in length, containing small irregularly-shaped, brownish seeds. The whole plant is of a sage green colour.

Cultivate in fall and spring; hand pull or run mower over crop so as to clip flowers off the weeds and thus prevent them from seeding.



BIRD RAPE--*Brassica campestris*, L.



An introduced annual, very similar in nature and growth to wild mustard, but smooth and glaucous. It is equally troublesome, and should be treated as recommended for the mustard. Spraying, however, is not as effective with this plant.

WILD RADISH—*Raphanus raphanistrum*, L.

This vile weed of European origin has just been reported from several points in the province and may be looked for when imported seed has been sown. In general appearance it is like the wild mustard, but its yellow flowers have purplish veins on the petals, and the pods are more jointed in appearance, containing brown coloured seeds, larger and not quite so spherical as those of mustard. Great care should be taken to eradicate it by hand pulling carefully when first noticed. It is an annual, spreading only from seed.

YELLOW WHITLOW GRASS—*Draba nemorosa*, var.

A slender branching winter annual growing to a height of 6 or 8 inches with very small yellow flowers and narrow flat seed pods about three-eighths of an inch in length. It is very abundant some seasons on stubble, attracting a good deal of attention. It often ripens its seed before ploughing for summer-fallow is done. Cultivate fall or spring and summer-fallow early.



PEPPERGRASS—*Lepidium intermedium*, Gray.

A common native plant, annual and winter annual, which has some seasons made such a growth early in the season that grain crops have been choked down. It has been especially troublesome in stubble crops. It grows to a height of 6 to 18 inches, the leaves falling away as the plant ripens, when its slender spreading branches are covered with flat pods about one-sixteenth of an inch in diameter, each containing two seeds of a brownish reddish colour. Cultivate fall and spring, or summer-fallow.

PRAIRIE ROSE—*Rosa arkansana*, Porter.

A native perennial shrub with spreading rootstocks which are especially troublesome if the breaking and backsetting of the land has not been thorough. Where a field is badly infested with them the ploughing for summer-fallow should be done with a sharp share and subsequent cultivation throughout the season with a cultivator or disc. No crops should be sown on stubble, spring ploughing would be preferable.

COMMON EVENING PRIMROSE—*Oenothera biennis*, L.

A tall, stout native plant of biennial habit. Its leaves are from one to six inches long, pointed, narrowed at the base and closely attached to the stem, or short stalked. Its flowers, which open at night, are yellow and the seed pods grow close to the stem, about an inch in length, containing small irregularly shaped brown seeds. This weed is seldom troublesome except where crops have been sown on stubble and is easily destroyed by fall and spring cultivation, its growth the first season being only a rosette of leaves from which the next season the flowering stalk rises.

WHITE-STEMMED EVENING PRIMROSE—*Anogra pallida*, V.
leptophylla.

A native perennial, growing on sandy soil and proving somewhat persistent owing to its deep-running rootstocks. Its stem and branches are smooth and white and sometimes with shreddy bark. The leaves are from one to four inches long, very narrow and wavy. The flowers are from one to one and a half inches broad and waxy white or pink in colour.

Plough deep and cultivate as recommended for Canada Thistle.



White-Stemmed Evening Primrose.

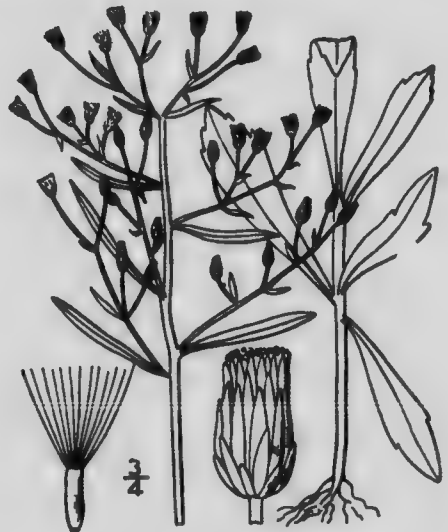
WESTERN SNOWBERRY, OR WOLFBERRY—*Symphoricarpus occidentalis*, Hook.



A native shrub growing on the prairie to a height of two or three feet, and, where cultivation is not thorough, continuing to live and spread its rootstocks through the soil. Treatment should be a good clean summer-fallow as for the rose bush.

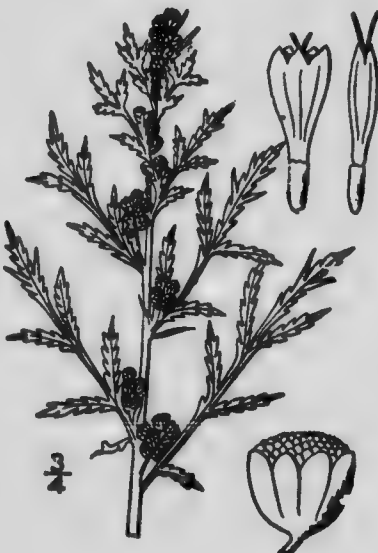
FLEABANE, OR HORSEWEED—*Erigeron Canadensis*, L.

A native annual and winter annual growing from six inches to several feet in height and sometimes known as "Fireweed." Its flowers are in numerous small whitish heads and its seeds are spread by the wind. Cultivate fall and spring, or summer-fallow early.



POVERTY WEED—*Iva axillaris*, Pursh.

A perennial native plant less than a foot in height but having tough spreading underground stems. Its flowers are small and not conspicuous, hanging short stalked in axils of the upper leaves; leaves are rough, narrow and about an inch in length. This weed has been found very difficult to eradicate and needs well directed persistent effort with sharp implements. Clean deep ploughing for summer-fallow and frequent shallow cultivation afterwards should be effective.

FALSE TANSY—*Artemisia biennis*, Willd.

A coarse, rank growing, strong-scented native plant of biennial habit, and most abundant in low, damp portions of the fields. Its leaves are dark green and finely divided. The flowers are inconspicuous and only appear during the second year of growth. In crops sown on stubble the stout stalks interfere seriously with the work of the binder. Fall or spring ploughing or careful discing will destroy it if you do not wish to summer-fallow.

BLUE LETTUCE—*Lactuca pulchella* DC.

A native plant which is perennial, with spreading rootstocks. It grows from two to three feet high, with smooth, deeply-toothed leaves, from which a milky juice exudes when broken. Its flowers are light blue and about three-quarters of an inch broad. Should be treated as recommended for Canada thistle.

HAIRY MINT—*Stachys palustris*, L.

A pale green, hairy, perennial of the mint family, growing naturally in low land, but after a series of wet seasons giving trouble in the grain fields of Northern Alberta because of the rapid spread of its rootstocks through the soil. Its leaves are three or four inches in length and placed opposite on the angled stem. The flowers are pale lavender in colour. To eradicate it plough for summer-fallow when it is in bloom in hot dry weather and cultivate frequently throughout the season. Drainage will have a good effect.



LAMB'S QUARTERS—*Chenopodium album*, L.

An annual weed with both native and introduced forms. It grows to a height of six feet under favourable conditions, but, without attaining any such height, succeeds in robbing the grain fields of a great deal of fertility and moisture without apparently exciting suspicion or hostility on the part of the farmer. There is, no doubt, more loss caused by this weed than by any other, few fields of grain being found without it, and no seed being more commonly found in the screenings at elevators. The plant is so well known that it is hardly necessary to describe it, but all may not be as familiar with the appearance of the seed, which is round and flattened or lens-shaped, and is shiny black in colour when the outer covering is removed. Easily eradicated by shallow cultivation or the use of the harrow when plants are just above ground. Summer-fallow is effective when finished by late fall or spring cultivation.

SPEARLEAF GOOSEFOOT—*Monolepis chenopodioides*, Moq.

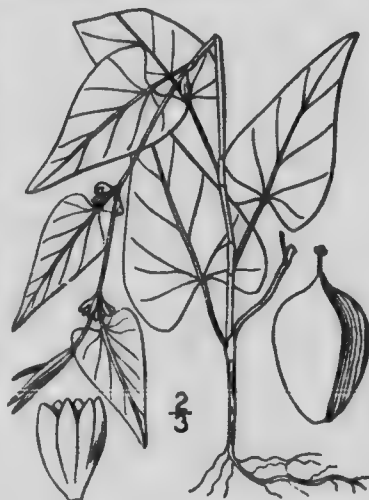
A low spreading native annual, dark green in colour, with inconspicuous flowers. The leaves somewhat resemble in shape those of lamb's-quarters, or of sheep sorrel. It makes an early growth and in this way smothers the young wheat or oats. Many bare spots in crops have been caused by this weed, which is not hard to kill by the ordinary methods adopted for annual weeds. The use of the drag harrows or weeder is effective.

TUMBLEWEED—*Amarantus albus* L.

A low, white-stemmed branching annual which breaks off when ripe and drifts over the prairie. Easily controlled by using the harrows or weeder.

WILD BUCKWHEAT—*Polygonum convolvulus*, L.

An annual climber with arrow-shaped leaves and small whitish flowers, producing triangular, dull, black seeds which retain their brown covering to some extent. This weed is very abundant in the grain fields and the seeds are often found to a large extent in oats offered for sale. The young plants are easily damaged by frost so cultivation that will start germination in the fall is good practice. Early ploughing for summer-fallow is necessary, as partially matured seeds may grow when turned under.



COUCH GRASS—*Agropyrum repens*, L., and *glaucum* R. & S. var.

A slender perennial grass with tough creeping rootstocks which spread through the soil for a depth of three or four inches. The heads are narrow, and seed is ripened about August or September. The introduced form is dark yellowish green in colour while the native is pale bluish green. The latter is a prairie grass which is excellent for pasture but may be classed as a weed when found in grain fields. Careless breaking and neglect of the headlands is largely responsible for its appearance in cultivated lands. The treatment recommended for the eradication of these grasses is shallow ploughing during hot, dry weather, followed by frequent cultivation.

BARLEY GRASS—*Hordeum jubatum*, L.

Also called squirrel-tail, skunk-tail, wild barley and fox tail.

This well known native grass which is rather a weed of the hay-field than of the grain crop is a source of much injury to horses, cattle and sheep. The bearded heads when taken into the mouth break up, adhere to and penetrate the mucous membrane. They also work in between the teeth and under the tongue causing inflammation and ulcers which eventually affect the jaw bones. It grows most abundantly on alkaline soils where the conditions are not so favourable for the growth of better grasses. There is no difficulty in eradicating it from any land

which can be ploughed, as the usual method of breaking in June will destroy it. It gives most trouble, however, by growing on waste places where it ripens its seed, which is spread abroad by wind and water. It grows freely about the edges of hay sloughs on the prairie and is generally ripe before any hay is cut. The remedy in this case would be cutting before the seeds are formed. In a wet season, probably a second cutting would be necessary to prevent any seed ripening. If this course were continued for a few seasons the pest would die a natural death, but it is the usual practice not only to cut too late but also to avoid cutting the borders of sloughs in dry seasons when the grass is thin: needless to state, such methods favour the further spread

of the objectionable grass. When fields of brome grass are found to be badly infested probably it will be better to break and backset them and take a grain crop off before reseeding, or if preferred the field may be burned over in the fall to destroy such seed of the barley grass as may have fallen and, early in the spring, ploughed shallow, then harrowed and rolled. In this way the brome may be renewed without reseeding and most of the barley grass will have been destroyed.

Excessive irrigation is said to favour the growth and spread of this weed. Ditches and roads should be kept free of it.

SWEET GRASS--*Hierochloa borealis*, R. & S.

A native sweet-scented perennial grass which is found in low parts of the prairie. It has a spreading head, golden brown in colour and ripens seeds early in June. Its rootstocks penetrate much deeper than those of the couch grass and are especially difficult to eradicate from cultivated fields during wet seasons. In Alberta and Saskatchewan the method that has given most satisfaction has been deep, clean ploughing, just before the seeds ripen, followed by heavy seeding to barley or rye. After the crop has been removed and as late as frost will allow, the land should be again ploughed. At the Indian Head Experimental Farm, Mr. Mackay preferred a different method. He says, "We find that to plough early or when in flower only helps this weed. I would advise ploughing deeply, in the latter part of July or in the beginning of August, then harrow well and repeat in September and October. With us when ploughed early every root in the ground grows, while if ploughed after dry weather, when the growing season is over, it is easily killed."



Sweet Grass.

PLANTS INJURIOUS TO STOCK.

At various times and seasons there have been inquiries made by correspondents of this department and the agricultural papers regarding the causes of fatalities occurring on farm and range which were thought to be due to poisonous weeds. When possible these cases were investigated, but generally information came too late to permit of much light being thrown on the matter. I have gathered from various sources some information regarding the plants growing between Manitoba and the Rocky Mountains which are known to be of an injurious character to stock, and I hope that this may lead to the acquisition of further knowledge. The Department of Agriculture of the United States, and various experiment stations, have issued valuable bulletins dealing with this subject, and I shall quote or summarise what seems most suited to our purpose. Most of the illustrations are derived from the bulletins mentioned.

The plants which cause fatalities are not all poisonous, but the injury is sometimes more than compensated for as in the case of the

CROCUS ANEMONE—*Anemone patens* v. *nuttalliana*.

This is a beautiful purplish cup shaped flower that is very abundant in some localities in the early spring. Close observation on the



part of some Alberta shepherds showed that deaths were frequent in a bunch of sheep after feeding greedily on these flowers, and a microscopical and chemical investigation by Professors Fletcher and Shutt, of Ottawa, proved that numerous balls of felt, composed of the fine hairs with which the plant is covered, formed in the stomachs and impaired the digestion to such an extent as to frequently prove fatal. I have, however, taken from an old sheep as many as seventeen balls which varied in size from a marble to a large egg. This ewe was known as a "piner."

A shepherd should avoid letting his sheep graze where the anemone is abundant.

SPEAR GRASS—*Stipa spartea*, Trin.

SPEAR GRASS—It has been known for years that this grass makes victims of some of the lambs in seasons which have been favourable for the production of seed, but it is a valuable grass for winter grazing, as the barbed seeds have then fallen.

BARLEY GRASS—*Hordeum jubatum*, L.

SQUIRRELTAIL, SKUNKTAIL OR BARLEY GRASS—This grass causes trouble of a mechanical nature when prevalent in hay fed to horses or sheep. The awned seeds work into the mucous membranes of the mouth and throat to such an extent that ulceration of the jaw bones may be the result, or an enlargement may be produced which may be mistaken for actinomycosis. Hay meadows where there is much of this grass should be cut early enough to prevent the seed developing.

FIELD HORSETAIL—*Equisetum arvense*, L.

Horsetail or Scouring-rush, growing naturally in low shady places, has been very abundant in some localities that have experienced excessive rainfall, and suspicion has turned to it. There is apparently no evidence against the weed here, although several species of it have been accused of poisoning horses, cattle and sheep in Europe and America, but investigations by the U.S. Department of Agriculture do not seem to bear out the supposition that the plant contains a specific poison. I have also noticed the following reference:



It appears probable that *Equisetum arvense* often causes serious poisoning of horses in Vermont and is fatal when eaten in considerable quantity. It is believed to be the cause of blind or stomach staggers, and is doubtless the cause of more loss to stock owners in Vermont than any other plant. Conflicting evidence is presented relating to its poisonous action in reference to sheep. Cattle are said to feed upon it with impunity.

The consumption of a large quantity of any species of the horsetail would probably cause derangement of the system because of its harsh scouring action in the mouth and intestinal tract due to the large proportion of silica in its composition.

SMUT OF OATS—*Ustilago avenae*.

OAT SMUT—When abundant in a crop which may be cut for green feed, oat smut may cause irritation and congestion. A number of fatalities amongst cattle in Northern Alberta have been laid to this. In Montana a lot of cows were fed on smutty hay and within twelve hours after the first feed one-half of them died with symptoms of gastritis and cerebral excitement. No more of the hay was fed and no more deaths resulted. A *post mortem* examination showed the stomachs much congested. This is another argument in favour of treating the seed grain with formalin.

ERGOT—*Claviceps purpurea*.

Ergot—Ergot has been extremely abundant on the prairie some seasons in a number of native grasses and also in timothy. It is probable, therefore, that ergotism may develop from the feeding of hay containing this fungus growth. Abortion in the flocks of sheep on our Western ranges appears to have been due to ergot. A warning bulletin on this subject was issued by the Kansas Experiment Station, and I will quote from it:

Ergot is a fungus which replaces the ordinary seed or grain with a black or brown black grain, cylindrical, pointed and slightly curved. Cold weather and scarcity of drinking water seem to favour development of ergotism. Ergot lessens the blood supply and the tail or ears may swell, get cold, die and slough off. When the feet are affected the animal gets very lame. Ergot causes abortion, and also affects the nervous system, causing trembling of the muscles, weakness, staggering gait, and sometimes convulsions. The digestive system is often affected and there may be purging, indigestion and abdominal pain. Cattle are more seriously affected than horses. Avoid feeding ergot. A purge of one pound of Epsom salts for adult cattle or a quart of raw linseed oil for horses should be given. Give sloppy, nutritious foods, with plenty of drinking water. Bathe affected parts with hot water, rub to stimulate circulation and apply antiseptics such as 5 per cent carbolic solution.

A limited number of species of the many hundreds of flowering plants which are native to the province are known to be poisonous, and most of these are not attractive in taste, but are eaten with or in lieu of grass. Some of these are only harmful at certain stages of their growth, and one part of a plant may be injurious while at the same time another part may be innocuous or even nutritious. These varying conditions make investigation more difficult and evidence conflicting. We have plants in abundance which are of the same species as some that prove fatal to stock in other places, yet they seem to be harmless here. I will note a number which have bad reputations and will treat more fully those against which we have good evidence.

CROWFOOT—*Ranunculus* sp.

CROWFOOT OR BUTTERCUP—This family is found represented by many different species, and the juice of them is of a more or less acrid, blistering nature. The active principle is volatile, so these weeds will be harmless when in hay. The symptoms of poisoning by species of buttercup in Europe are said to be nauseous vomitings, salivation, colic, diarrhoea, albuminuria, staggering, stupefaction, trembling, falls, apoplecticiform death. Treatment should be symptomatic. Tannin is advisable.

LARKSPUR—*Delphinium scopulorum* and *bicolor*.

LARKSPUR—Two species of this occur and are both fatal to stock. One grows to a height of from three to five feet and is found about the edges of the poplar bluffs in Alberta and Saskatchewan; the other seldom exceeds a foot in height and grows on the slopes of the Cypress Hills and westward to the foothills. Both have purple flowers and leaves cleft in a palmate manner. It appears that the time to expect larkspur poisoning is in the spring and early summer while the plants are fresh and juicy. The symptoms shown by an affected animal are stiffness and a slight irregularity of gait and straddling of the hind legs in walking. It falls and rises with the muscular movements incoördinate and the muscles and legs quivering spasmodically. The final stages are accompanied by violent spasms with intervals of rest, while in poisoning from death camas the last stages are passed in a state of paralysis, although the symptoms at first are somewhat alike. Atropine is considered the best antidote for the physiological effects, while permanganate of potash and sulphate of aluminum should be used as a chemical antidote. It would not be a difficult matter for farmers to root out the tall larkspur from the bluffs about their farms.

BANEBERRY—*Actaea spicata*, L. var.

BANEBERRY—This plant grows in the shade of the willows and species of it produce red or white oval shining berries at a height of a foot or so. No cases of poisoning from this plant have yet been recorded here, but children should be warned against it.

CORN COCKLE—*Agrostemma Githago*, L.

a, sprays, showing flowers and seed capsule, one-third natural size; b, seed, natural size; c, seed, four times natural size.

CORN AND COW COCKLE.—These two plants are not natives, but are becoming rapidly abundant in the grain fields as troublesome weeds, and their seeds have formed the principal part of the screenings at some points in Saskatchewan recently. The seeds of the first mentioned are extremely difficult to separate from wheat. The poisonous constituent in each is saponin, the action of which is antagonised by the extract of digitalis, a powerful poison. The most dangerous part of cockle is the seed, and care should be exercised that it may be removed from wheat before milling, and from food for stock. Chronic poisoning may be induced, resulting in diarrhoea and gradual depression, with death. Acute poisoning is indicated by vomiting, headache, nausea, vertigo, diarrhoea, hot skin, pains in back, difficult locomotion and depressed breathing. Coma is sometimes present and is followed by death.*

FLAX—*Linum* sp.

LARGE-FLOWERED YELLOW FLAX grows on our prairies, although not conspicuous. It has been experimented with in the States and proved poisonous to sheep.

BLUE FLAX (*L. usitatissimum*)—In Europe the cultivated flax has caused poisoning sometimes in the pig, cow, sheep, and in poultry; this is due to acrid narcotic poison (linine) contained in the seed capsules and possibly in sickly plants. Although animals seem to thrive at stacks of flax straw in this country casualties may occur. The symptoms are: Violent colics, diarrhoea, staggering, trembling, palpitation of heart and death in convulsions. The treatment must be symptomatic.

WILD BEAN—*Thermopsis rhombifolia*, Rich.

THERMOPSIS OR WILD BEAN has been suspected of poisoning cattle, but no direct evidence is to hand, though several cases have occurred at various points in Saskatchewan where children have eaten portions of the plant and have suffered from it. In one case several boys, while walking over the prairie, ate the seeds from the bean-like pods and were very quickly affected with giddiness, headache, nausea

*In recent publications of the United States Department of Agriculture it is stated that poultry raisers in some of the states are losing many fowls on account of corn cockle in commercial chicken feed sold there.

and extreme weakness. They, however, recovered after emetics were administered. In another case children were affected by eating the flowers. *Thermopsis* grows about eight to twelve inches in height, has yellow flowers, in shape like pea blossoms, which produce curved pods about four inches in length, and the leaves are composed of three leaflets.

LUPINE—*Lupinus sp.*

LUPINE—The Lupine grows very abundantly in some sections of Alberta and about the Cypress Hills, and is excellent food for stock when eaten green or in hay if cut at the right time. It is a member of the pea family with an upright stalk on which are clustered the blue or cream coloured flowers. The leaves are palmately divided, the leaflets being about seven in number and somewhat silvery in appearance. The fruit is a hairy pod about an inch and a half in length and half an inch in width, and in the seed lies the danger. It has been found that the seeds contain hydrocyanic acid in such quantity that large numbers of sheep have been poisoned by having been fed lupine hay. It seems that the hay had been made just when the pods were well filled but not ripe enough to allow the seeds to drop, as they will do if permitted. The presence of fully formed seeds constitutes the danger in hay containing this plant. In lupine poisoning there is acute cerebral congestion with great mental excitement. Frenzy is followed by irregularity of movement, violent spasms and falling fits. Collapse and death often follow in half an hour or more. After an animal is down convulsions follow at short intervals. These convulsions resemble those caused by strychnine. The urine is much increased and sometimes bloody. Affected animals sometimes linger for several days, the pulse being weak and respiration slow after the first day. It has been advised to try potassium permanganate and aluminum as a remedy.

SNEEZEWEED—*Helenium autumnale*, L.

Sneezeweed has a yellow flower similar in shape to that of a sunflower, but only about an inch and a half across. It grows in low, damp places and the flowers are known to be poisonous if eaten in quantity, but stock generally avoid it. Difficult breathing, quickened pulse, staggering and extreme sensitiveness to touch are the symptoms, and fatal cases end in spasms and convulsions. Malted barley has been used with good effect.



STEMLESS LOCO WEED—*Oxytropis lamberti*, Pursh.

a, flowering plant; b, seed pods; c, cross-section of seed pod. All one-third natural size.

LOCO WEED—This is a term applied to several species of the pea family which have been suspected of causing serious trouble in the flocks and herds of the Western States. The eating of the loco seems to be an acquired habit which has recently been observed to some extent on our side of the line in ranching districts and a good many affected horses have been brought over for sale. Two species, *Oxytropis lamberti* and *O. splendens*, are abundant from Manitoba to the Rockies. The flowers of the former are mostly pale yellow; those of the latter are purple, and this plant has a much more silvery appearance than *lamberti*. The U.S. government is still investigating the subject of loco poisoning, as it is not yet thoroughly understood. The symptoms are drooping head, rough coat and irregularities in gait and action, such as may be produced in man by alcohol. Sight is frequently affected to a greater or lesser extent, and so also is hearing. In chronic cases of the loco habit in sheep the animal becomes emaciated and crazy, perhaps sheds all or part of the wool and becomes unable to care for itself and may lose sight of the band. Fits of trembling are of frequent occurrence until death from exhaustion and inadequate nutrition is the result.*

WILD CHERRY—*Prunus* sp.

CHOKE CHERRY—This cherry should need no description, as it is well known, but few are aware that the leaves are capable of causing death. Should young shoots of this be mown with grass and fed to animals, while the leaves are half wilted, poisoning might result as chemical action produces prussic acid, which is also yielded by the seeds. The kernels of cherries or plums should never be eaten, but in case of a person being thus poisoned, use emetics, wash out the stomach with dilute solution of peroxide of hydrogen and call in a physician. The symptoms of cherry poisoning in cattle are heavy breathing, weak pulse, numbness, protruding eyes, convulsions and death from paralysis of the lungs. In some cases frothing at the mouth, and in all an odour of prussic acid in the breath.

*Bulletin 121 of U.S. Bureau of Plant Industry gives the result of recent investigations of loco poisoning stating that locoed cattle can in most cases be cured by a course of treatment with strychnine, while locoed horses can generally be cured by the use of Fowler's solution. The animals under treatment should not be allowed to eat the loco weed and should be given nutritious food with so far as possible laxative properties. Magnesium sulphate may be administered to correct the constipation usual and this drug, it is stated, may serve to some extent as an antidote to the poison. It is stated that barium in the plants appears to be responsible for the poisonous action and that loco plants from certain soils are inactive pharmacologically and contain no barium.

WATER HEMLOCK—*Cicuta occidentalis*.



CICUTA, WATER HEMLOCK OR POISON PARSNIP—This is a plant which in Europe and the various parts of America is known to be harmful. Although several species occur in different localities the poisonous properties seem to be much the same. It is parsnip-like in appearance, but the flowers are white, and it is found growing in low, damp places or on banks of creeks and lakes, being much more abundant after a series of wet seasons. It may be distinguished by the cluster of fleshy roots, which have a sweet aromatic odour. These roots are the most poisonous part of the plant, containing as they do a volatile oil, which is especially powerful after the stalks have died away in the fall

and till new plants have grown in the spring. It would not, however, be safe to say that the stems, leaves and seeds are not poisonous, as it would seem that a number of horses were affected by cropping portions of cicuta growing in a pasture near Regina in the latter part of August. The symptoms in this case were: "Diarrhoea with weakness, temperature about 103 degrees. Two showed partial paralysis with slight muscular spasms. The heart action was irregular and of a tumultuous nature. All recovered." In this case the animals must have had a very small quantity of the poison, which is so strong that a piece of the root the size of a marble may prove fatal to man. The symptoms of cicuta poisoning of sheep as observed in Montana were an attempt to run in any direction, cerebral frenzy, accompanied by involuntary muscular movements, which suggest colic; the respiration was laboured and irregular, the pulse wiry and intermittent. In some cases of cattle being poisoned they died within fifteen minutes of the first signs. Sheep have died suddenly at various points in the Maple Creek district for several seasons, and the writer was asked to look over the range for the cause of this loss. In every case where deaths have been frequent cicuta was found to be growing near where the sheep had been watered. Permanganate of potash should be promptly administered and morphine may be given hypodermically as follows: For sheep, $1\frac{1}{2}$ grains; for cattle and horses, 3 to 10 grains. If drugs are not handy, try melted lard. The Indians are said to successfully treat persons who have been poisoned by cicuta by giving about 4 drachms of gunpowder in less than a pint of water well stirred, and then giving lukewarm water as an emetic.

THREE-FLOWERED NIGHTSHADE—*Solanum triflorum*, Nutt.



One-third natural size.

THREE-FLOWERED NIGHTSHADE OR WILD TOMATO is a common garden weed, with a strong musky smell. It produces green berries resembling small tomatoes, and these have been known to cause death when eaten in quantity. I have observed sheep eating these plants about the badger holes in August with apparent impunity. The poisonous property is probably solanin.

DEATH CAMAS—*Zygadenus venenosus*, S. Wats.

DEATH CAMAS OR POISON SEGO—One of the most dangerous weeds on the western ranges is this plant. It grows in abundance in Southern Alberta. Large numbers of sheep have been affected in the early summer by the prevalence of this weed amongst the grass on which they were grazing. The plant has a bulb like that of a young onion, and the leaves are almost grass-like. The flowers are yellowish and waxy in appearance and are clustered on the stem at a height of about 10 to 15 inches. The species is botanically known as *Zygadenus venenosus*, but we have also *Z. elegans* growing very thickly in the more northern sections. The latter is slightly coarser and has larger flowers than the former but it is apparently avoided by stock or losses would be frequent. The first signs of poisoning in sheep are uneasiness and irregularity in the movement, rapidly becoming more pronounced and accompanied by incoordination of the muscular movements, spasms and rapid breathing. The cerebral conditions seldom constitute a condition of frenzy. The later symptoms were complete motor paralysis, combined with rapid shallow breathing and a frequent weak pulse. There was usually an increased salivation and regurgitation through the mouth and nostrils. Digestive disturbances in the lambs were frequently of an acute nature in the form of enteritis and dysentery, from which they died in a few hours. In cases where the ewes had only been slightly poisoned the lambs showed milder symptoms, but could readily be detected by their stiffness of joint. It has been found by the U.S. Department of Agriculture that a combination of diuretin and caffeine is a satisfactory antidote and can be given by means of a hypodermic syringe very rapidly. This acts on the kidneys and seems to carry off the poison.

POISON IVY—*Rhus toxicodendron*, L.

POISON IVY—Poison ivy is found in coulees and other wooded sections of the province and persons are sometimes reported to have been poisoned by it. The poisonous principle is a nonvolatile oil known as toxicodendrol and cannot be washed off the skin with water alone, but may be removed by alcohol. An alcoholic solution of sugar of lead is said to be effective if well rubbed in. The effects of the poison on persons is well known, but there appears to be much difference of opinion as to how cattle may be affected by it. In this connection I will quote from Bulletin No. 20 of the U.S. Department of Agriculture: "All poisonous plants are not equally injurious to all persons,

nor to all forms of life. The most familiar illustration of this is to be found in the action of poison ivy. It has no apparent external effect upon animals, and a few of them, such as the horse, mule and goat, eat its leaves with impunity." And again, in a report of the Bureau of Animal Industry: "The leaves of the various species of poisonous Rhus, for example, are eaten by several, if not all kinds of stock with impunity, and even with considerable relish." These statements do not coincide with replies sometimes seen in the columns of our agricultural papers to the effect that poison ivy causes sloughing of the skin, etc., in cattle.

A large number of other plants are known to possess poisonous properties but are either avoided by cattle or occur in no considerable quantity. If persons having animals poisoned would report such cases promptly to the department they could be investigated and we would soon know more about these matters. Certainly there is much to learn.

NOXIOUS INSECTS.

The prevention of injury by insect pests can only be referred to very briefly in these pages, but certain rules and remedies may be given whereby the ravages of this or that insect may be checked while we are making further inquiry regarding the name and nature of our undesirable visitors; then, when the necessary information is received, treatment on general principles may give way to that best suited to each species. For our purposes we may divide insects injurious to vegetation into classes according to the nature of their mouth parts and mode of feeding.

BITING INSECTS.

Class 1 comprises those that bite or nibble the plants they attack; potato beetles, flea beetles, red turnip beetles, poplar beetles, grasshoppers, cutworms and other kinds of caterpillars will come under this head and may be destroyed by means of poisonous substances placed on the food plants.

Of these poisons the one most commonly used is Paris green, either dry or in the form of a spraying liquid, which is prepared by mixing $\frac{1}{4}$ lb. Paris green, $\frac{1}{4}$ lb. lime and 50 gallons of water. First make part of the Paris green into a paste with some warm water, add the balance and then pour in the lime after having slaked it in a little water.

The dry mixture is made by mixing 1 lb. of Paris green with about 50 lbs. of flour, fine wood ashes or air-slaked lime, and should be dusted over the affected plants, if possible while the dew is on them. This may be readily done by placing the mixture in a small muslin or cheese-cloth sack; the sack is then tied to the end of a short thick stick and hung at a convenient height over the crop; when tapped with a light stick a small quantity of the powder is deposited on the plants to be protected.

White hellebore can be more safely used than the above, and Dr. J. Fletcher says it is very suitable for some of the leaf-eating insects of small fruits, particularly the caterpillars of the currant saw-fly. It can be applied as a dry powder or as a liquid mixture, 1 oz. to 2 gallons of water.

Bran mash made with Paris green, $\frac{1}{2}$ lb., bran 20 lbs., a little molasses, and water sufficient to moisten, may be placed in quantities here and there throughout the gardens, and will prove very destructive to cutworms and grasshoppers.

Criddle mixture has been found even more effective for grasshoppers. To prepare it take one part Paris green, two parts salt, 100 parts fresh horse dung (by measure). Mix thoroughly, adding enough water to make soft without being sloppy. Scatter well with a trowel in quantity according to the number of locusts.

SUCKING INSECTS.

Class 2 includes those insects (bugs, plant-lice, etc.) which suck the juices of the plants by means of a sharp beak which is driven into

the tissues thus making ineffectual any poison placed on the surface the leaves. For these it is necessary to resort to external application which kill the insects by mere contact with their bodies.

These act on the breathing organs of the insects and one of the most useful is The Kerosene Emulsion. It may be prepared by dissolving $\frac{1}{4}$ pound of hard soap or 1 quart of soft soap in 2 quarts of water, a pint of kerosene should be added and the mixture thoroughly stirred by means of a syringe or force pump. It will then be a thick and creamy mass capable of being diluted with hard or soft water to the extent of 4 quarts.

The Riley-Hubbard formula which is the one almost universally adopted is as follows:

Kerosene (coal oil).....	2 gallons.
Rain water	1 gallon.
Soap	$\frac{1}{2}$ lb.

Dissolve soap in water by boiling; take from fire, and, while hot, turn in kerosene and churn briskly for 5 minutes. To be diluted before use with 9 parts of water.

For bark-lice and other sucking insects.

Whale-oil soap 1 lb. to 6 or 8 gallons of water has been highly recommended for application to soft-bodied insects such as plant-lice. The potash soaps are the best.

Pyrethrum or insect powder if fresh is very good for use on food plants and is not poisonous to man or beast. Dr. Fletcher says it is very effective for nearly all caterpillars and especially for those of the cabbage butterfly, if mixed with four times its weight of flour and kept in a tightly closed vessel for twenty-four hours. It can also be mixed with water in the proportions of 1 oz. to 2 gallons and in this way is destructive to plant lice.

Tobacco boiled in water, 1 lb. to 2 gallons of water is used for killing plant lice and also flea-beetles.

Many other preparations have been recommended for destroying insect pests of garden and field, but they are largely modifications of some of those already mentioned.

MECHANICAL METHODS are often employed and good work may be done in many cases by hand-picking or the shaking of the infested plants over a shallow pan containing water with a small amount of kerosene on the surface. This plan should be useful in the case of potato beetles or Western blister beetles when these are not in excessive numbers.

A heavy roller has been sometimes used with advantage where cutworms were damaging field crops, and is most effective at night when the caterpillars are at the surface feeding.

Hopper dozers or large shallow sheet iron pans on low runners are drawn over the fields by horse power. In these pans which have backs about 2 feet high made of canvas, against which grasshoppers jump and fall back, a little kerosene and water is poured, and the canvas is also kept oiled. Any locust or other insect that comes in contact with the oil is doomed.

PREVENTIVE MEASURES.

The gathering together and burning in the fall of all rubbish about gardens will have a very good effect by destroying many young caterpillars and also preventing cutworm moths, etc., from laying their eggs. Burning of stubble in the fall is a very good practice, as innumerable insects will be destroyed, and it is also well to burn screenings and refuse after threshing. In this way pupæ of Hessian fly and larvæ of other wheat flies will be disposed of.

Deep ploughing late in the fall will expose to the weather many insects, and will bury others in the egg or more advanced stages.

Carbolic acid as a wash has been recommended by several authorities as being of service to protect radishes, onions, etc., from maggots. This is prepared by adding 2 quarts of soft soap to 2 gallons of water into which when boiling 1 pint of crude carbolic acid is turned. Dilute with 50 parts of water and sprinkle on the plants as soon as they are above ground.

Young plants of cabbage, tomatoes, etc., may be protected from cutworms by placing bands of stiff paper or tin about them.

Rotation of crops is desirable when fields are affected.

There are some grubs known as wireworms, the larvæ of click beetles, that are very destructive to crops on new land in some districts and can only be controlled by cultural methods. The eggs are laid about the roots of grass and weeds in summer and most of the species spend two years in the larval form, being then yellowish brown grubs, tough and shining. They pupate in the ground and although they are mature beetles about August many of them remain in their cells in the ground through the winter. When sod land is broken the wireworms feed mostly that season on the old grass and roots and those of full growth do no further harm but those in the first year of growth attack the farmer's first crop because it is all they have to feed on. Barley and rye are said to be less liable to attack than other grains and might therefore be sown in preference to wheat and the land fall ploughed immediately after harvest when the pupæ and beetles would to a large extent be destroyed. Farmers in some parts have had good results by following this ploughing after harrowing by a later ploughing just before winter.

In case of any occurrence of injurious insects, it will be advisable for farmers to send specimens, with an account of the injury, to the Department of Agriculture, Regina.

GOPHERS.

Three species of *Spermophilus*, known as gophers or ground squirrels, are found in the province, one of them being striped and the other two gray in colour. In some years, especially dry seasons, they are very abundant and do considerable damage to the crops in thinly settled districts. At such times there are many inquiries for poison with which to reduce the number of these pests, but there has been no unanimity or continuity of effort in this direction. To be really effective such work should be systematically and persistently carried on from year to year, advantage being taken of any reduction in numbers due to natural causes, such as wet seasons or disease, when extra effort should be made to clear the remainder off the farms. Some farmers make a practice of carrying a few traps while ploughing, and set one after passing a gopher, picking it up with the gopher next time round. Poisoning is best done early in the spring, when the appetites of the little animals are very keen and before their numbers have been increased by breeding. Directions for the preparation of the poison are given below.

Hawks are of great assistance in keeping down the number of gophers, and farmers should in their own interest see that these birds are not destroyed. Only a few of the many species of hawks interfere with the farmers' fowls and the loss from that source is a mere trifle. The pocket gophers and mice levy quite a heavy tax on the crops and, as they move about at night, are preyed on more by the owls than the hawks.

Free distribution of gopher poison was made by the government several years ago, but the farmers did not systematically co-operate with the department and it was discontinued.* The agricultural societies have power to devote a portion of their funds to the "extermination of such animals as are found to injure or impede agriculture," and no doubt it might be money well spent to devote some of this to the destruction of gophers.

A formula for the preparation of poison, as recommended by various authorities, is as follows:

STRYCHNINE POISON.—Dissolve one and a half ounces of strychnine sulphate in a quart of hot water, add a quart of molasses and a tablespoonful of oil of anise. Thoroughly heat and mix the liquid. While hot pour it over a bushel of clean wheat and mix completely in a tight vessel. Then mix in a few pounds of fine meal to take up the moisture and adhere to the grain. Let it stand overnight and then distribute about a tablespoonful in a hole.

FUMIGATION WITH CARBON BISULPHIDE.—This method has been found successful by many who have used it. A great deal depends upon the quality of the carbon bisulphide. The usual method of use is to put about a tablespoonful of the liquid on a piece of dry horse dung, or other suitable material and roll it down the burrow, which should at once be plugged up with earth. Four parts of gasoline with one of carbon bisulphide is said to be as effective and cheaper, but about double the quantity must be used.

*During the seasons of 1907 and 1908 local improvement district councils were advised that half of any amount less than \$40 expended for gopher poison, distributed by them free to their ratepayers, in any township would be refunded to their district by the government. Facilities were also placed in their way for procuring a supply of poison.

SMUT.

It may be considered safe and profitable to make a rule that no grain should be sown on the farm without first being treated for the prevention of smut. The loss from this fungus growth in the plant is seldom realized by the grain growers but its decrease of the yield alone is well worth considering as, in an exceptional case, even 90% of smutty heads have been recorded in a wheat plot. Even a small quantity of smut in a load of grain reduces its value greatly and prevents ready sale. The preventive treatment is quite simple and should not be neglected. Bluestone has been largely used for wheat with satisfactory results and formalin is highly recommended for use on all grains, but care should be taken that the latter chemical is of standard 40% strength.

Dissolve one pound bluestone (copper sulphate) in hot water and add water to the extent of 5 or 6 gallons. The wheat may be dipped in this or merely sprinkled and mixed so that it be all thoroughly dampened.

Formalin solution is used at a strength of 1 lb. (16 fluid ounces) to from 52 to 40 gallons of water, it being sufficient in the case of wheat to dip or sprinkle, but oats require to be soaked from 5 to 10 minutes. Grain should be covered and left in a pile for an hour or so after being treated but should be sown within 24 hours.

Further information as to smut may be found in Bulletin 2, which may be had on application.

POTATO SCAB.

This disease may be prevented by soaking the seed potatoes for an hour and a half in a corrosive sublimate solution, $2\frac{1}{4}$ ounces thoroughly dissolved in 2 gallons of hot water and diluted with 13 gallons water. Use a wooden tub and handle the potatoes in sacks. Formalin is also used for the same purpose, $\frac{1}{2}$ pint of formalin to 15 gallons of water, the potatoes being soaked two hours and then dried. Land on which clean potatoes or on which no potatoes have been grown should be chosen for the crop.

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